

Test Report

WARRES No. 132422

BS 476: Part 7: 1997
Method For Classification Of The
Surface Spread Of Flame Of Products

Sponsored By

American Building Technologies Inc.
600 17th Street
Suite 2800 South
Denver
CO 80202
United States of America

Warrington
FIRE
research

Test Report

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Surface Spread Of Flame Of Products

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600 17th Street
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1 Purpose Of Test

To determine the classification of specimens of a product when they are tested in accordance with BS 476: Part 7: 1997, "Fire tests on building materials and structures, method for classification of the surface spread of flame of products".

2 Scope Of Test

BS 476: Part 7: 1997 specifies a method of test for measuring the lateral spread of flame along the surface of a specimen of a product orientated in the vertical position, and a classification system based on the rate and extent of flame spread. It provides data suitable for comparing the performances of essentially flat materials, composites, or assemblies, which are used primarily as the exposed surfaces of walls or ceilings.

3 Description Of Test Specimens

The description of the specimens given below has been prepared from information provided on behalf of the sponsor of the test. All values quoted are nominal, unless tolerances are given.

The specimens comprised a coated aluminium faced composite wall cladding panel (product reference 'Alubond u.s.a Aluminium Composite Panel', colour reference 'ALM 104 Metallic Silver'), having an overall thickness of 4mm and an overall weight of 7.45kg/m².

The cladding panel was stated by the sponsor to comprise a 3mm thick mineral core, having a weight of 4.65kg/m², with a coil coated aluminium sheet bonded to both faces utilising a continuous co-extrusion manufacturing process, with the coated aluminium faces exposed.

The decorative (tested) coated aluminium sheet comprised 0.5mm thick chromate pretreated aluminium sheet coated on the exposed face with a 5 micron thick epoxy resin primer and a 15 micron thick P.P.G Industries 'Kynar 500' PVDF coating, colour reference 'ALM 104 Metallic Silver'.

The reverse coated aluminium sheet comprised 0.5mm thick chromate pretreated aluminium sheet coated on the exposed face with a 10 micron thick service coating, colour reference 'White'.

The sponsor was unable to provide further details of the composition of the product.

The specimens were tested with a 25mm enclosed air gap positioned between the unexposed face of the product and the backing board.

The specimens were supplied by the sponsor. Warrington Fire Research Centre was not involved in any selection or sampling procedure.

4 Conditioning Of Specimens

The specimens for testing to BS 476: Part 6: 1989 together with the specimens for testing to BS 476: Part 7: 1997 were received on the 22nd May 2003.

Prior to the tests, all of the specimens were conditioned to constant mass at a temperature of $23 \pm 2^{\circ}\text{C}$ and a relative humidity of $50 \pm 10\%$. One specimen from the total sample submitted for test was selected for constant mass verification

5 Date Of Test

The test was performed on the 29th May 2003.

6 Test Procedure

The test was performed in accordance with the procedure specified in BS 476: Part 7: 1997, and this report should be read in conjunction with that British Standard.

Each specimen was placed over 25mm thick by 20mm wide calcium silicate based spacers positioned around its perimeter and mounted onto a backing board so that a 25mm enclosed air gap was provided between the unexposed face of the specimen and the backing board.

7 Form In Which The Specimens Were Tested

The specimens were tested in the form of an assembly.

8 Exposed Face

The PVDF (colour reference 'ALM 104 Metallic Silver') face of the specimens was exposed to the radiant heat of the test when the specimens were mounted in the test position.

9 Test Results And Classification

The test results relate only to the behaviour of the test specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.

The test results relate only to the specimens of the product in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and may therefore invalidate the test results. Care should be taken to ensure that any product which is supplied or used is fully represented by the specimens which were tested.

The test results for the individual specimens, together with observations made during the test and comments on any difficulties encountered during the test are given in Table 1.

IN ACCORDANCE WITH THE CLASS DEFINITIONS GIVEN IN BS 476: PART 7: 1997, THE SPECIMENS TESTED ARE CLASSIFIED AS CLASS 1.

Note: If the prefix 'D' or suffix 'R' or 'Y' is included in the classification, this indicates that the results should be treated with caution. An explanation of the reason for the prefix and suffixes is given in Appendix 1, together with the irradiance along the horizontal reference line of the specimen position during the test and the classification limits specified in the Standard.

10 Interpretation Of Test Results

Attention is drawn to Appendix 2 entitled "Effect of thermal characteristics on the performance of assemblies".

11 Validity

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

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Responsible Officer

Approved



J COAKLEY
Technical Officer
Reaction to Fire Testing

P E LYTHGOE
Testing Manager
Reaction to Fire Testing
For and on behalf of
WARRINGTON FIRE RESEARCH CENTRE

Date Of Issue : 25th July 2003

Table 1

SPECIMEN No.	1	2	3	4	5	6
Maximum distance travelled at 1.5 minutes (mm)	50	50	50	50	50	50
Distance (mm)	Time to travel to indicated distance (minutes, seconds)					
75						
165						
190						
215						
240						
265						
290						
375						
455						
500						
525						
600						
675						
710						
750						
785						
825						
900						
Time to reach maximum distance travelled (minutes, seconds)	1.00	1.00	1.00	1.00	1.00	1.00
Maximum distance travelled in 10 minutes (mm)	50	50	50	50	50	50

Note: Six specimens are usually tested. If the test on any specimen is deemed to be invalid, as defined in the Standard, it is permissible for up to a maximum of nine specimens to be tested in order to obtain the six valid test results.

OBSERVATIONS MADE DURING TEST AND COMMENTS ON ANY DIFFICULTIES ENCOUNTERED DURING THE TEST.

NONE.

Appendix 1

Irradiance along the horizontal reference line of the specimen position during the test.

Distance along reference line from the hotter end of the specimen position (in mm)	75	225	375	525	675	825
Irradiance at points specified above (kW/m ²)	32.5	21.0	14.5	10.0	7.0	5.0

Note: a tolerance of ± 0.5 kW/m² is specified on the irradiance measurement.

Classification of spread of flame

CLASSIFICATION	SPREAD OF FLAME AT 1.5 MIN		FINAL SPREAD OF FLAME	
	LIMIT	LIMIT FOR ONE SPECIMEN IN SAMPLE	LIMIT	LIMIT FOR ONE SPECIMEN IN SAMPLE
	<u>mm</u>	<u>mm</u>	<u>mm</u>	<u>mm</u>
Class 1	165	165 + 25	165	165 + 25
Class 2	215	215 + 25	455	455 + 45
Class 3	265	265 + 25	710	710 + 75
Class 4	exceeding the limits for Class 3			

Explanation of prefix and suffixes which may be added to the classification

1. A suffix R is added to the classification if more than six specimens are required in order to obtain six valid test results (e.g. class 2R).
2. A prefix D is added to the classification of any product which does not comply with the surface characteristics specified in the Standard and has therefore been tested in a modified form (e.g. class D3).
3. A suffix Y is added to the classification if any softening and/or other behaviour that may affect the flame spread occurs (e.g. class 3Y).

For example, a classification of D3RY could be achieved indicating (a) a modified surface has been used; (b) a class 3 result has been obtained; (c) additional specimens have been used to obtain 6 valid results and; (d) softening and/or other behaviour has occurred which is considered to have affected the test result.

Appendix 2

Effect of Thermal Characteristics on the Performance of Specimens

The result of the test in accordance with BS 476: Part 7: 1987 is applicable only to the specimens in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and may therefore invalidate the test result. It is important that the specimens which are tested fully represent the product which is supplied and the manner in which it will be used. This may require a product to be tested in a number of different ways to determine the classification which will be achieved in its different methods of use.

A surface coating, for example, may be applied to a selected substrate using a particular method and application rate. The test classification which is achieved for that set of specimens will be applicable only to that situation. If the substrate or method and rate of application in a particular practical situation are different from that which was tested, then it will be necessary to determine the classification which will be achieved for that situation. Similarly, specimens incorporating a wallcovering must be fully representative of the situation which occurs in practice and will normally consist of the wallcovering bonded to a chosen substrate with a chosen adhesive; the test result will only apply to that composite system. The same principle applies to any composite or assembly which is being investigated.

It is sometimes possible to assume a 'worst case' situation which will enable a chosen set, or sets, of specimens to be constructed and tested to provide a foundation for the assessment of the probable performance of variations within the system. Similarly, it is sometimes possible to formulate a series of exploratory tests to investigate the effect of variations within a product or system, usually culminating in a series of formal tests to provide the basis for a composite assessment of pre-determined variables. In such cases, however, it is essential that careful planning of the programmes is undertaken by suitably qualified fire safety practitioners.

The following is re-produced from Appendix B of BS 476: Part 7: 1997;

With thin materials or composites, particularly those with a high thermal conductivity, the presence of an air gap and the nature of any underlying construction may significantly affect the ignition performance of the exposed surface. Increasing the thermal capacity of the underlying construction increases the "heat sink" effect and may delay ignition of the exposed surface. Any backing provided to the test specimen and in intimate contact with it, such as the non-combustible spacers, may alter this "heat sink" effect and may be fundamental to the test result itself. The influence of the underlying layers on the performance of the assembly should be understood and care should be taken to ensure that the result obtained on any assembly is relevant to its use in practice.

The following advice is offered on the construction and preparation of test specimens;

- (a) Where the thermal properties of the product are such that no significant heat loss to the underlying layers can occur, e.g. a material or composite greater than approximately 6 mm thick of high thermal capacity and/or low thermal conductivity, then the product should be tested backed only by the backing board.
- (b) Where the product is normally used as a free-standing sheet and the characteristics noted in (a) do not apply, then an air space should be provided at the back of the product by testing over spacers of non-combustible insulation board 20 mm wide and (25 ± 1) mm thick.
- (c) Where the product is to be used over a low density non-combustible substrate and the characteristics noted in (a) do not apply, then the product should be tested in conjunction with that substrate.
- (d) Where the product is to be used over a combustible substrate and the characteristics noted in (a) do not apply, then the product should be tested in conjunction with that substrate.

NOTE: Discussions are taking place in ISO/TC92/SC1 concerning the possible use of a restricted range of reference substrates (mainly non-combustible) where it is not apparent or possible to test materials or products in the representative end-use substrate.

Test Report

WARRES No. 132424

BS 476: Part 6: 1989
Method Of Test For
Fire Propagation For Products

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Test Report

WARRES No. 132424

BS 476: Part 6: 1989
Method Of Test For
Fire Propagation For Products

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600 17th Street
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United States of America

1 Purpose Of Test

To determine the fire propagation index of specimens of a product when they are tested in accordance with BS 476: Part 6: 1989 'Fire tests on building materials and structures, method of test for fire propagation for products'.

2 Scope Of Test

BS 476: Part 6: 1989 specifies a method of test, the result being expressed as a fire propagation index, that provides a comparative measure of the contribution to the growth of fire made by an essentially flat material, composite or assembly. It is primarily intended for the assessment of the performance of internal wall and ceiling linings.

3 Description Of Test Specimens

The description of the specimens given below has been prepared from information provided on behalf of the sponsor of the test. All values quoted are nominal, unless tolerances are given.

The specimens comprised a coated aluminium faced composite wall cladding panel (product reference 'Alubond u.s.a Aluminium Composite Panel', colour reference 'ALM 104 Metallic Silver'), having an overall thickness of 4mm and an overall weight of 7.45kg/m².

The cladding panel was stated by the sponsor to comprise a 3mm thick mineral core, having a weight of 4.65kg/m², with a coil coated aluminium sheet bonded to both faces utilising a continuous co-extrusion manufacturing process, with the coated aluminium faces exposed.

The decorative (tested) coated aluminium sheet comprised 0.5mm thick chromate pretreated aluminium sheet coated on the exposed face with a 5 micron thick epoxy resin primer and a 15 micron thick P.P.G Industries 'Kynar 500' PVDF coating, colour reference 'ALM 104 Metallic Silver'.

The reverse coated aluminium sheet comprised 0.5mm thick chromate pretreated aluminium sheet coated on the exposed face with a 10 micron thick service coating, colour reference 'White'.

The sponsor was unable to provide further details of the composition of the product.

The specimens were tested with a 12.5mm airspace at the back of the product by testing over non-combustible perimeter battens 20mm wide and 12.5mm thick.

The specimens were supplied by the sponsor. Warrington Fire Research Centre was not involved in any selection or sampling procedure.

4 **Conditioning Of Specimens**

The specimens for testing to BS 476: Part 6: 1989 together with the specimens for testing to BS 476: Part 7: 1997 were received on the 22nd May 2003..

Prior to the tests, all of the specimens were conditioned to constant mass at a temperature of $23 \pm 2^{\circ}\text{C}$ and a relative humidity of $50 \pm 10\%$. One specimen from the total sample submitted for test was selected for constant mass verification

5 **Date Of Test**

The test was performed on the 12th & 13th June 2003.

6 **Test Procedure**

The test was performed in accordance with the procedure specified in BS 476: Part 6: 1989 and this report should be read in conjunction with that British Standard.

7 **Form In Which Specimens Were Tested**

The specimens were tested in the form of an assembly.

8 **Exposed Face**

The PVDF (colour reference 'ALM 104 Metallic Silver') face of the specimens was exposed to the heating conditions of the test.

9 **Test Results**

The test results relate only to the behaviour of the test specimens of the product under the particular conditions of test, they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.

The test results relate only to the specimens of the product in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and may therefore invalidate the test results. Care should be taken to ensure that any product which is supplied or used is fully represented by the specimens which were tested.

A total of three specimens was tested. The laboratory record sheet relating to each of the test specimens is appended to this report.

Throughout the test on each specimen careful observation was made of the product's behaviour within the apparatus and special note was taken of any of the phenomena listed in clause 10.2 of the Standard. None of the listed phenomena was observed and the test results on all three specimens tested were valid.

The following test results were obtained for the product.

Fire propagation index, I	=	2.6
subindex, i_1	=	0.0
subindex, i_2	=	0.1
subindex, i_3	=	2.5

NOTE: If a suffix 'R' is included in the above fire propagation index, I, then this indicates that the results should be treated with caution.

10 Interpretation Of Test Results

Attention is drawn to Appendix 1, entitled 'Effect of thermal characteristics on the performance of assemblies'.

11 Validity

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

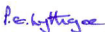
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Responsible Officer



J COAKLEY
Technical Officer
Reaction to Fire Testing

Approved



P E LYTHGOE
Testing Manager
Reaction to Fire Testing
for and on behalf of
WARRINGTON FIRE RESEARCH CENTRE

Date Of Issue: 25th July 2003

Appendix 1

Effect of Thermal Characteristics on the Performance of Assemblies

The result of a test in accordance with BS 476: Part 6: 1989 is applicable only to the specimens in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and may therefore invalidate the test result. It is important that the specimens which are tested fully represent the product which is supplied and the manner in which it will be used. This may require a product to be tested in a number of different ways to determine the classification which will be achieved in its different methods of use.

A surface coating, for example, may be applied to a selected substrate using a particular method and application rate. The test classification which is achieved for that set of specimens will be applicable only to that situation. If the substrate or method and rate of application in a particular practical situation are different from that which was tested, then it will be necessary to determine the classification which will be achieved for that situation. Similarly, specimens incorporating a wallcovering must be fully representative of the situation which occurs in practice and will normally consist of the wallcovering bonded to a chosen substrate with a chosen adhesive; the test result will apply only to that composite system. The same principle applies to any composite or assembly which is being investigated.

It is sometimes possible to assume a 'worst case' situation which will enable a chosen set, or sets, of specimens to be constructed and tested to provide a foundation for the assessment of the probable performance of variations within the system. Similarly, it is sometimes possible to formulate a series of exploratory tests to investigate the effect of variations within a product or system, usually culminating in a series of formal tests to provide the basis for a composite assessment of pre-determined variables. In such cases, however, it is essential that careful planning of the programmes is undertaken by suitably qualified fire safety practitioners.

The following is re-produced from Appendix B of BS 476: Part 6: 1989:

With thin materials or composites, particularly those with a high thermal conductivity, the presence of an air gap and the nature of any underlying construction may significantly affect the ignition performance of the exposed surface. Increasing the thermal capacity of the underlying construction increases the "heat sink" effect and may delay ignition of the exposed surface. Any backing provided to the test specimen and in intimate contact with it, such as the non-combustible packing pieces, may alter this "heat sink" effect and may be fundamental to the test result itself. The influence of the underlying layers on the performance of the assembly should be understood and care should be taken to ensure that the result obtained on any assembly is relevant to its use in practice.

The following advice is offered on the construction and preparation of test specimens:

- (a) Where the thermal properties of the product are such that no significant heat loss to the underlying layers can occur, e.g. a material/composite greater than approximately 6 mm thick of high thermal capacity and/or low thermal conductivity, then the product should be tested backed only by the specimen holder.
- (b) Where the product is normally used as a free-standing sheet and the characteristics noted in (a) do not apply, then an airspace should be provided at the back of the product by testing over asbestos cement perimeter battens 20 mm wide and 12.5 mm thick.
- (c) Where the product is to be used over a low density non-combustible substrate and the characteristics noted in (a) do not apply, then the product should be tested in conjunction with that substrate.
- (d) Where the product is to be used over a combustible substrate and the characteristics noted in (a) do not apply, then the product should be tested in conjunction with that substrate.

Laboratory Record Sheet**FIRE PROPAGATION TEST - B.S.476:PART 6:1989**

Sponsor : American Building Technologies Inc

Specimen No : 1

Date : 12/06/03

Time mins t	Specimen Temperature Deg C Ts	Calibration Temperature Deg C Tc	Ts-Tc/10t	Sub Index Of Performance
0.50	14	14	0.00	
1.00	20	21	0.00	
1.50	25	25	0.00	
2.00	29	28	0.05	
2.50	33	32	0.04	
3.00	37	37	0.00	0.09
4.00	68	73	0.00	
5.00	102	109	0.00	
6.00	129	135	0.00	
7.00	152	157	0.00	
8.00	167	178	0.00	
9.00	186	191	0.00	
10.00	197	203	0.00	0.00
12.00	317	216	0.84	
14.00	320	223	0.69	
16.00	329	231	0.61	
18.00	322	235	0.48	
20.00	324	237	0.44	3.07
Total Index of Performance S			=	3.16

SubIndex s₁ 0.09SubIndex s₂ 0.00SubIndex s₃ 3.07

Index of Performance S 3.16

Laboratory Record Sheet**FIRE PROPAGATION TEST - B.S.476:PART 6:1989**

Sponsor : American Building Technologies Inc

Specimen No : 2

Date : 12/06/03

Time mins t	Specimen Temperature Deg C Ts	Calibration Temperature Deg C Tc	Ts-Tc/10t	Sub Index Of Performance
0.50	13	14	0.00	
1.00	18	21	0.00	
1.50	23	25	0.00	
2.00	28	28	0.00	
2.50	33	32	0.04	
3.00	37	37	0.00	0.04
4.00	71	73	0.00	
5.00	107	109	0.00	
6.00	135	135	0.00	
7.00	158	157	0.01	
8.00	177	178	0.00	
9.00	191	191	0.00	
10.00	228	203	0.25	0.26
12.00	308	216	0.77	
14.00	318	223	0.68	
16.00	313	231	0.51	
18.00	308	235	0.41	
20.00	307	237	0.35	2.71
Total Index of Performance S			=	3.02

SubIndex S₁ 0.04SubIndex S₂ 0.26SubIndex S₃ 2.71

Index of Performance S 3.02

Laboratory Record Sheet**FIRE PROPAGATION TEST - B.S.476:PART 6:1989**

Sponsor : American Building Technologies Inc

Specimen No : 3

Date : 13/06/03

Time mins t	Specimen Temperature Deg C Ts	Calibration Temperature Deg C Tc	Ts-Tc/10t	Sub Index Of Performance
0.50	11	14	0.00	
1.00	17	21	0.00	
1.50	22	25	0.00	
2.00	26	28	0.00	
2.50	30	32	0.00	
3.00	36	37	0.00	0.00
4.00	68	73	0.00	
5.00	107	109	0.00	
6.00	130	135	0.00	
7.00	151	157	0.00	
8.00	173	178	0.00	
9.00	187	191	0.00	
10.00	195	203	0.00	0.00
12.00	222	216	0.05	
14.00	284	223	0.44	
16.00	306	231	0.47	
18.00	309	235	0.41	
20.00	299	237	0.31	1.68
Total Index of Performance S			=	1.68

SubIndex s₁ 0.00SubIndex s₂ 0.00SubIndex s₃ 1.68

Index of Performance S 1.68